

Written Amendment
(Amendment based on Section 11)

To Mr. Seiji HAMADA, Examiner at the Patent Office

1. Identification of the International Application

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4. Object of Amendment: Claims

5. Contents of Amendment

(1) In Claim 1, misspelling in the original Japanese specification for the terms corresponding to "p-type" and "n-type" is amended. The third paragraph "the p-type semiconductor layer having a bandgap that increases from the n-type semiconductor layer side to the first electrode layer side monotonically;" is deleted and the last paragraph "in the p-type semiconductor layer, a first region at the n-type semiconductor layer side and a second region at the first electrode layer side being different from each other in a bandgap increase rate in a direction of thickness of the p-type semiconductor layer" is amended to "the p-type semiconductor layer comprising a first region at the n-type semiconductor layer side and a second region at the first electrode layer side, the bandgap of the p-type semiconductor layer increasing in the first region at a predetermined rate from the n-type semiconductor layer side to the first electrode side, and

increasing in the second region at a rate smaller than the increase rate in the first region from the n-type semiconductor layer side to the first electrode side”.

(2) In Claim 7, the second paragraph “an atom number ratio of Ga to the group IIIb elements in the p-type semiconductor layer increases from the n-type semiconductor layer side to the first electrode layer side monotonically,” is deleted and the third paragraph “in the p-type semiconductor layer, the first region at the n-type semiconductor layer side and the second region at the first electrode layer side are different from each other in the atom number ratio in a direction of thickness of the p-type semiconductor layer” is amended to “an atom number ratio of Ga to the group IIIb elements in the p-type semiconductor layer increases in the first region at a predetermined increase rate from the n-type semiconductor layer side to the first electrode layer side, and increases in the second region at an increase rate smaller than the increase rate in the first region from the n-type semiconductor layer side to the first electrode layer side”.

(3) In Claim 9, the second paragraph “an atom number ratio of Al to the group IIIb elements in the p-type semiconductor layer increases from the n-type semiconductor layer side to the first electrode layer monotonically,” is deleted and the third and the following paragraphs “in the p-type semiconductor layer, the first region at the n-type semiconductor layer side and the second region at the first electrode layer side are different from each other in the atom number ratio in a direction of thickness of the p-type semiconductor layer, and the first region at the window layer side and the second region at the first electrode layer side in the semiconductor layer are different from each other in the increase rate of the atom number ratio” are amended to “an atom number ratio of Al to the group IIIb elements in the p-type semiconductor layer increases in the first region at a predetermined increase rate from the n-type semiconductor layer side to the first electrode layer side, and increases in the second region at an increase rate smaller than the increase rate in the first region from the n-type semiconductor layer side to the first electrode layer side”.

(4) Claims 4, 8 and 10 are cancelled.

6. List of appended documents

New sheets of pages 37-39 for Claims

1 set

CLAIMS

1. (Amended) A solar cell comprising: a first electrode layer, a second electrode layer, a p-type semiconductor layer interposed between the first electrode layer and the second electrode layer, and a n-type semiconductor layer interposed between the p-type semiconductor layer and the second electrode layer,
 - the p-type semiconductor layer comprising a compound semiconductor that contains a group Ib element, a group IIIb element and a group VIb element and that has a chalcopyrite structure,
 - a bandgap of the p-type semiconductor layer on the main surface at the n-type semiconductor layer side being at least 1.08 eV,
 - a bandgap of the p-type semiconductor layer on the main surface at the first electrode layer side being at least 1.17 eV, and
- 15 the p-type semiconductor layer comprising a first region at the n-type semiconductor layer side and a second region at the first electrode layer side, the bandgap of the p-type semiconductor layer increasing in the first region at a predetermined rate from the n-type semiconductor layer side to the first electrode layer side, and increasing in the second region at a rate smaller than the increase rate in the first region from the n-type semiconductor layer side to the first electrode layer side.
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- 25 2. The solar cell according to claim 1, wherein the bandgap of the p-type semiconductor layer on the main surface at the n-type semiconductor layer side is at least 1.2 eV.
3. The solar cell according to claim 1, wherein the bandgap of the p-type semiconductor layer on the main surface at the first electrode layer side is at least 1.3 eV.

4. (Cancelled)

5. The solar cell according to claim 1, wherein the group Ib element is Cu, the group IIIb element is at least one element selected from the group 5 consisting of In, Ga and Al, and the group VIb element is at least one element selected from the group consisting of Se and S.

6. The solar cell according to claim 1, wherein the group IIIb element is at least one element selected from the group consisting of In, Ga and Al, and 10 a content of the at least one element in the p-type semiconductor layer changes in a direction of thickness of the p-type semiconductor layer.

7. (Amended) The solar cell according to claim 6, wherein
the group IIIb elements comprises Ga,
15 an atom number ratio of Ga to the group IIIb elements in the p-type semiconductor layer increases in the first region at a predetermined increase rate from the n-type semiconductor layer side to the first electrode layer side, and increases in the second region at an increase rate smaller than the increase rate in the first region from the n-type semiconductor layer side to 20 the first electrode layer side.

8. (Cancelled)

9. (Amended) The solar cell according to claim 6, wherein
25 the group IIIb elements comprise Al,
an atom number ratio of Al to the group IIIb elements in the p-type semiconductor layer increases in the first region at a predetermined increase rate from the n-type semiconductor layer side to the first electrode layer side, and increases in the second region at an increase rate smaller than the 30 increase rate in the first region from the n-type semiconductor layer side to

the first electrode layer side.

10. (Cancelled)

5 11. The solar cell according to claim 7, wherein the atom number ratio of the p-type semiconductor layer on the main surface at the n-type semiconductor layer side is at least 0.1, and

 the atom number ratio of the p-type semiconductor layer on the main surface at the first electrode layer side is at least 0.25.

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12. The solar cell according to claim 11, wherein the atom number ratio of the p-type semiconductor layer on the main surface at the n-type semiconductor layer side is at least 0.3.

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13. The solar cell according to claim 11, wherein the atom number ratio of the p-type semiconductor layer on the main surface at the first electrode layer side is at least 0.45.